PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-237623

(43)Date of publication of application : 31.08.1999

(51)Int.Cl. G02F 1/1335

(21)Application number : 10-039357

(22)Date of filing : 20.02.1998

(71)Applicant : SEIKO EPSON CORP

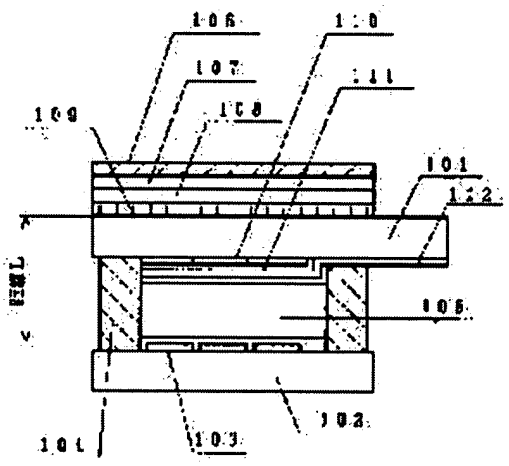
(72)Inventor : MAEDA TSUYOSHI

(54) LIQUID CRYSTAL DEVICE AND ELECTRONIC APPLIANCE

(57)Abstract:

PROBLEM TO BE SOLVED: To suppress blurring (defocusing), color mixture, etc., of a display due to a scatter plate as to a reflection type liquid crystal device which has the scatter plate and a mirror surface reflecting layer.

SOLUTION: The liquid crystal device has a liquid crystal layer 105 sandwiched between a 1st substrate 101 and a 2nd substrate 102, the scatter plate 109 and a polarizing plate 106 arranged in order on the 1st substrate 101 on the side different from the liquid crystal layer 105, and a reflecting layer formed on the surface of the 2nd substrate 102 on the side of the liquid crystal layer 105. In this case, the distance L between the scatter plate 109 and reflecting layer 106 is so set that 300 μm≤L≤1000 μm. Further, the relation between the pixel pitch P and the distance L is made 1≤L/P≤101.



LEGAL STATUS

[Date of request for examination] 07.12.2000

[Date of sending the examiner's decision of rejection] 20.08.2002

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of 2002-18207

rejection]

[Date of requesting appeal against examiner's decision of rejection] 19.09.2002

[Date of extinction of right]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the electronic equipment which used liquid crystal equipment and this liquid crystal equipment.
[0002]
[Description of the Prior Art] Conventionally, many things which have arranged the reflecting plate are used for the tooth-back side of the liquid crystal cell which comes to close a liquid crystal layer between two transparence substrates as liquid crystal equipment of a reflective mold. In the liquid crystal equipment of such a reflective mold, according to a class, a drive method, etc. of a liquid crystal layer, a polarizing plate may be arranged, a polarizing plate may be arranged only to the front-face side of liquid crystal equipment, or a polarizing plate may not be needed at all before and after a liquid crystal cell.
[0003] In the high-reflective-liquid-crystal equipment of such a format, after outdoor daylight carries out incidence to a liquid crystal layer through the transparence substrate by the side of a front face, penetrates the transparence substrate by the side of a rear face and is reflected with a reflecting plate, the transparence substrate by the side of the transparence substrate by the side of a rear face, a liquid crystal layer, and a front face is passed again, and it is checked by looking. In this case, since spacing arises by the thickness of the transparence substrate by the side of a rear face between a liquid crystal layer and the reflector of a reflecting plate and the pixel field of a liquid crystal layer or dot field through which it passes depending on whenever [incident angle / of outdoor daylight] at the time of incidence differs from the pixel field or dot field of a liquid crystal layer through which it passes after reflection, there is a trouble that a blot, a double image, etc. of a display by the so-called parallax occur.
[0004] As the technique of solving the above troubles, the reflecting plate made to reflect outdoor daylight is formed in the inside of a liquid crystal cell, and there is a thing of abolishing parallax as indicated by JP,9-113893,A.
[0005]
[Problem(s) to be Solved by the Invention] However, in the liquid crystal equipment of the reflective mold indicated by JP,9-113893,A, since the diffusion plate which consists of two kinds of minute fields which have a different refractive index is arranged in the front face of a liquid crystal cell, there is a trouble that a blot (dotage) of the display with a diffusion plate occurs. It uses in order to obtain a bright display, even if this diffusion plate loses the feeling of the feeling metallurgy group of a mirror plane of a reflecting plate and is not the direction of specular reflection of outdoor daylight, but it will be intermingled by the time different information on each different pixel for dispersion with this diffusion plate is recognized by human being's eyes. That is, supposing it is performing the white display and the black display by the adjacent pixel, respectively, for a diffusion plate, the boundary of a white display and a black display will become unclear, and a display will fade.
[0006] Moreover, also in a device which colorization of a liquid crystal display is required with development of a pocket device in recent years and OA equipment, and uses high-reflective-liquid-crystal equipment, colorization is required in many cases. However, by the approach which combined the liquid crystal equipment indicated by the above-mentioned official report and a color filter, a blot (dotage) of a display occurs for dispersion with a diffusion plate, and there is a trouble that sufficient coloring cannot be obtained.
[0007] In addition, although the approach also form a scattered plate in a liquid crystal cell inside, and it controls a blot (dotage) of a display is proposed as indicated by JP,7-28055,A and JP,7-36060,A, become cost quantity, dependability falls, or this has problems -- it is hard to acquire a desired dispersion property -- and has not resulted in utilization.
[0008] Then, this invention solves the above-mentioned trouble and it is in offering the liquid crystal equipment which stopped a blot (dotage), color mixture, etc. of a display with the diffusion plate of high-reflective-liquid-crystal equipment. Moreover, it is in offering the electronic equipment using this liquid crystal equipment.

[0009]
[Means for Solving the Problem] The means which this invention provided in order to solve the above-mentioned technical problem is as follows.
[0010] A liquid crystal layer is pinched between the 1st substrate and the 2nd substrate, sequential arrangement of a scattered plate and the polarizing plate is carried out at a different side from said liquid crystal layer of said 1st substrate, and liquid crystal equipment according to claim 1 is characterized by the distance L of said scattered plate and said reflecting layer being 300 micrometer<=L <=1000micrometer in the liquid crystal equipment with which it comes to form a reflecting layer in the field by the side of said liquid crystal layer of said 2nd substrate.
[0011] According to this means, since distance of a scattered plate and a reflecting layer can be made as short practical as possible, a blot (dotage) of the display by the scattered plate can be suppressed. Although it is desirable to make it approach as much as possible, and to arrange as for a scattered plate and a reflecting layer, as shown in drawing 4 , for example between a scattered plate 403 and a reflecting layer 411 The orientation film 410 (thickness: about 0.01 micrometers - about 0.3 micrometers), the liquid crystal layer 409 (thickness: about 2 micrometers - about 10 micrometers), The orientation film 408 (thickness: about 0.01 micrometers - about 0.3 micrometers), a transparent electrode 407 (thickness: about 0.1 micrometers - about 0.3 micrometers), A protective coat or an insulator layer 406 (thickness: about 0.5 micrometers - about 2 micrometers), the color filter layer 405 (thickness: about 0.5 micrometers - about 3 micrometers), a glass substrate 404 (thickness: about 300 micrometers - about 1500 micrometers), etc. intervene. A glass substrate 404 has the largest contribution at the distance L of a scattered plate 403 and a reflecting layer 411. If a glass substrate 404 is made thin too much, the problem of being easy to be divided will produce it. For this reason, it cannot be made extremely thin. However, if plastic film and a plastic plate are used, 300 micrometers or less will become possible.
[0012] The level (dotage) of a display was investigated by making into a parameter distance of the printed matter drawn in the resolution 2000 of a 132mmx220mm resolution chart, and a scattered plate. This result is shown in Table 1. Although, as for O of front Naka, the level whose blot of a display is satisfactory is seen and, as for **, a blot of a display is seen, as for the level and x which are satisfactory practically, the blot of a display shows the level which is seen clearly and has a problem. The result of Table 1 shows that the clear display which does not have a blot (dotage) of a display when the distance of printed matter and a scattered plate is 1000 micrometers or less is obtained. When the thickness of practical glass is taken into consideration, the range of the distance L of a scattered plate and a reflecting layer is 300 micrometers or more 1000 micrometers or less. The distance L of the 300-micrometer or more range of 700 micrometers or less is good still more preferably. If the distance L of a scattered plate and a reflecting layer is in this range, it will be very lightweight, and will be hard to break, and a clear display will be obtained.
[0013]
[Table 1]

	ケース1	ケース2	ケース3	ケース4	ケース5	ケース6
解像度チャートからの距離(μm)	100	300	700	1000	1100	1500
表示のレベル	○	○	○	○	△	×

[0014] Next, the scattered plate used for this invention is described. By choosing suitably the haze value (Hayes) called for by the ratio of the total light transmission measured by the integrating-sphere type light transmission measuring device, and scattered-light permeability, a scattered plate can control a blot (dotage) of a display. If Hayes is too small, the feeling of the feeling metallurgy group of a mirror plane of a reflecting layer will remain, and a bright and high definition display will not be obtained. On the other hand, if Hayes is too large, it becomes difficult to suppress a blot (dotage) of a display, it will be clear and the high definition display with high contrast will not be obtained. According to the experiment, the desirable range of Hayes was 60% or less 30% or more. Moreover, a scattered plate is Asia. There is no dispersion (backscattering) by the side of incident light which Professor Tohoku University Uchida has announced by Display95 and pp599-pp602, and what has main forward scattering is more desirable. An optical control film with directivity which is indicated by JP,9-113893,A is sufficient as a scattered plate.
[0015] As for liquid crystal equipment according to claim 2, a liquid crystal layer is pinched between the 1st substrate and the 2nd substrate. Sequential arrangement of a scattered plate and the polarizing plate is carried out at a different side from said liquid crystal layer of said 1st substrate, and the distance L of said scattered plate and said reflecting layer and relation of the pixel pitch P are characterized by being 1 <=L/P<=10 in the liquid crystal equipment with which it comes to form a reflecting layer in the field by the side of said liquid crystal layer of said 2nd substrate.
[0016] According to this means, it becomes possible to recognize without making the information on each pixel intermingled, and a blot (dotage) of the display by the scattered plate can be suppressed. The experimental result which

changed the distance L of a scattered plate and a reflecting layer, and observed the blot (dotage) of a display is shown in Table 2, seting the pixel pitch P as constant 240 micrometers. Although, as for O of front Naka, the level whose blot of a display is satisfactory is seen and, as for **, a blot of a display is seen, as for the level and x which are satisfactory practically, the blot of a display shows the level which is seen clearly and has a problem. From the result of Table 2, the distance L of a scattered plate and a reflecting layer and the relation of the pixel pitch P can suppress a blot (dotage) of a display according that it is 1 <=L/P<=10 to a scattered plate. Especially the industrial and practical range is 2 <=L/P<=6.

[0017]

[Table 2]

	ケース1	ケース2	ケース3	ケース4	ケース5	ケース6
画素ピッチP(μm)	240	240	240	240	240	240
距離L(μm)	240	550	700	1500	2400	3000
L／P	1.0	2.3	2.9	6.3	10.0	12.5
表示のレベル	○	○	○	○	△	×

[0018] Liquid crystal equipment according to claim 3 is characterized by coming to form said liquid crystal layer with the liquid crystal which has a negative dielectric anisotropy. When a dielectric constant anisotropy uses negative liquid crystal, liquid crystal is perpendicularly arranged to a substrate. Liquid crystal (liquid crystal molecule) can control the transparency condition of inclination light by control of electric field. It has the effectiveness that a viewing-angle property spreads sharply, by having used such liquid crystal.

[0019] Liquid crystal equipment according to claim 4 is characterized by said reflecting layer serving as a pixel electrode.

[0020] According to this means, since it is necessary to newly form neither an insulating layer nor a transparent electrode on a reflecting layer, distance of a reflecting layer and a scattered plate can be shortened. Moreover, since the reflector serves as the pixel electrode, it is not necessary to newly form a pixel electrode, and ends with low cost.

[0021] Liquid crystal equipment according to claim 5 is characterized by arranging at least one phase contrast plate between said 1st substrate and said polarizing plates.

[0022] According to this means, while a good display control is made in a reflective mold display, the effect of the color tones on coloring resulting from the wavelength dispersion of light etc. can be reduced. As for a phase contrast plate, it is desirable to arrange the distance L of a scattered plate and a reflecting layer between a polarizing plate and a scattered plate from a viewpoint of shortening.

[0023] Liquid crystal equipment according to claim 6 is characterized by said reflecting layer and said thing [having formed the 1st set of a color filter in the wooden floor].

[0024] According to this means, reflective mold color display without a blot (dotage) of a display is realizable. As for a color filter, it is desirable to have 30% or more of permeability to all the light of the 380nm or more wavelength range of 780nm or less. By doing in this way, bright reflective mold color display is realizable.

[0025] Electronic equipment according to claim 7 is characterized by carrying the liquid crystal equipment of any of claims 1-6, or a publication.

[0026] According to this means, the electronic equipment using the liquid crystal equipment which can perform the reflective mold display without a blot (dotage) of the display by the scattered plate etc. is realizable.

[0027]

[Embodiment of the Invention] Next, the operation gestalt which starts this invention with reference to an accompanying drawing is explained.

[0028] (The 1st operation gestalt) Drawing 1 is outline drawing of longitudinal section showing the structure of the 1st operation gestalt of the liquid crystal equipment concerning this invention. Although this operation gestalt is fundamentally related with the liquid crystal display of a passive-matrix mold, it is possible to apply also to the equipment of a active-matrix mold, the equipment of other segmental dies, and other liquid crystal equipments by the same configuration.

[0029] With this operation gestalt, the liquid crystal cell to which the closure of the liquid crystal layer 105 was carried out by the frame-like sealant 104 is formed between two substrates 101 and 102. The liquid crystal layer 105 consists of nematic liquid crystals with a predetermined twist angle. A color filter 110 is formed on the inside of the front transparence substrate 101, and the coloring layer of three colors of R (red), G (green), and B (blue) is arranged by this color filter by the predetermined pattern. The transparent protective coat 111 is covered on the front face of a color filter, and the transparent electrode 112 of the shape of two or more stripe is formed of ITO etc. on the front face of this protective coat. The orientation film is formed on the front face of a transparent electrode 112, and rubbing processing

is performed in the predetermined direction. Moreover, 107, 108, and a scattered plate 109 are arranged a polarizing plate 106 and two phase contrast plates on the external surface of the front transparence substrate 101.
[0030] On the other hand, on the inside of the back substrate 102, two or more arrays are carried out so that the reflector 103 of the shape of a stripe formed for every coloring layer of the above-mentioned color filter may intersect the above-mentioned transparent electrode 112. When it is equipment of the active-matrix mold equipped with the MIM component or the TFT component, each reflector 103 is formed in the shape of a rectangle, and is connected to wiring through an active component. This reflector 103 is formed of Cr, aluminum, etc., and that front face is the reflector in which the light which carries out incidence is reflected from the transparence substrate 101 side. On the front face of a reflector 103, the same orientation film as the above is formed.
[0031] First, the display of a reflective mold is explained. 107, 108, a scattered plate 109, and a color filter 110 are penetrated the polarizing plate 106 in drawing 1 , and two phase contrast plates, respectively, it is reflected by the reflector 103 after passing the liquid crystal layer 105, and outgoing radiation of the outdoor daylight is again carried out out of a liquid crystal cell from a polarizing plate 106. At this time, ******, a dark condition, and its middle brightness are controlled by applied voltage to the liquid crystal layer 105. A scattered plate 109 makes the feeling of the feeling metallurgy group of a mirror plane of a reflector 103 become cloudy, and is effective in enabling it to recognize a bright display also except the direction of specular reflection of outdoor daylight.
[0032] the thickness of each member used between the scattered plate and the reflecting layer with this operation gestalt -- a glass substrate 101 -- for 2 micrometers and the ITO transparent electrode 112, 0.3 micrometers and the orientation film are [550 micrometers and the color filter layer 110 / 1 micrometer and a protective coat (insulating layer) 111 / 0.2 micrometers and the liquid crystal layer 105] 7.5 micrometers in two-layer. If these are doubled, the distance L of a scattered plate 109 and a reflecting layer 103 will be set to 561 micrometers. Since this liquid crystal equipment was suppressing the blot (dotage) of the display by the scattered plate as much as possible, it was clear and the display of the good reflective mold of coloring with high contrast was obtained.
[0033] According to the configuration of this example which was mentioned above, reflective mold electrochromatic display equipment without a blot (dotage) of the display by the scattered plate etc. was realizable.
[0034] Although the reflecting layer serves as the pixel electrode with this operation gestalt, after forming a protective coat or an insulator layer on a reflecting layer, transparent electrodes, such as ITO, are formed, and it is good also as a pixel electrode.
[0035] (The 2nd operation gestalt) Drawing 2 is outline drawing of longitudinal section showing the structure of the 2nd operation gestalt of the liquid crystal equipment concerning this invention. Although this operation gestalt is fundamentally related with the liquid crystal display of a passive-matrix mold, it is possible to apply also to the equipment of a active-matrix mold, the equipment of other segmental dies, and other liquid crystal equipments by the same configuration.
[0036] With this operation gestalt, the liquid crystal cell to which the closure of the liquid crystal layer 205 was carried out by the frame-like sealant 204 is formed between two substrates 201 and 202. The liquid crystal layer 205 consists of nematic liquid crystals with a negative dielectric anisotropy. A color filter 209 is formed on the inside of a front transparence substrate, and the coloring layer of three colors of R (red), G (green), and B (blue) is arranged by this color filter by the predetermined pattern. The transparent protective coat 210 is covered on the front face of a color filter, and the transparent electrode 211 of the shape of two or more stripe is formed of ITO etc. on the front face of this protective coat 210. On the front face of a transparent electrode 211, the orientation film to which orientation of the liquid crystal is carried out perpendicularly is formed, and rubbing processing is performed in the predetermined direction. By this rubbing processing, the liquid crystal molecule has the pre tilt angle of about 85 degrees in the direction of rubbing.
[0037] On the other hand, on the inside of the back substrate 202, two or more arrays are carried out so that the reflector 203 of the shape of a stripe formed for every coloring layer of the above-mentioned color filter may intersect the above-mentioned transparent electrode 211. When it is equipment of the active-matrix mold equipped with the MIM component or the TFT component, each reflector 203 is formed in the shape of a rectangle, and is connected to wiring through an active component. This reflector 203 is formed of Cr, aluminum, etc., and that front face is the reflector in which the light which carries out incidence is reflected from the transparence substrate 201 side. On the front face of a reflector 203, the same orientation film as the above is formed. In addition, rubbing processing is not performed to this orientation film.
[0038] The metal membrane which carried out the spatter of the aluminum which added 1.0% of the weight of Nd by the thickness of 500A was used for the reflector 203. A polarizing plate 206 is arranged on the external surface of the front transparence substrate 201, and the phase contrast plate (quarter-wave length plate) 207 and the scattered plate 208 are arranged between the polarizing plate 206 and the transparent electrode 211.

[0039] The polarizing plate 206 in drawing 2 , the phase contrast plate 207, a scattered plate 208, and a color filter 209 are penetrated, respectively, it is reflected by the reflector 203 after passing the liquid crystal layer 205, and outgoing radiation of the outdoor daylight is again carried out out of a liquid crystal cell from a polarizing plate 206. At this time, ******, a dark condition, and its middle brightness are controlled by applied voltage to the liquid crystal layer 205.

[0040] With this operation gestalt, as shown in drawing 3 , the pixel pitch P is set to 180 micrometers, and 301 [1-pixel] consists of 3 dots, R (red), G (green), and B (blue). moreover, the thickness of each member used between the scattered plate and the reflecting layer -- a glass substrate -- for 2 micrometers and an ITO transparent electrode, 0.2 micrometers and the orientation film are [700 micrometers and a color filter layer / 2 micrometers and a protective coat (insulating layer) / 0.1 micrometers and a liquid crystal layer] 5 micrometers in two-layer. If these are doubled, the distance L of a scattered plate and a reflecting layer will be set to 709.3 micrometers. At this time, the relation of the distance L of the pixel pitch P, a scattered plate, and a reflecting plate is L/P=3.9. Since this liquid crystal equipment was suppressing the blot (dotage) of the display by the scattered plate as much as possible, it was clear and the display of the good reflective mold of coloring with high contrast was obtained.

[0041] According to the configuration of this example which was mentioned above, reflective mold electrochromatic display equipment without a blot (dotage) of the display by the scattered plate etc. was realizable.

[0042] Finally, the coloring layer of the color filter used for each above-mentioned operation gestalt is described. In each operation gestalt, once incident light penetrates one coloring layer of the color filters, a liquid crystal layer is passed and it is reflected by the reflector, and when performing a reflective mold display, after penetrating a coloring layer again, it is emitted. Therefore, with the liquid crystal equipment of the usual transparency mold, since two-times passage of the color filter will be carried out in things, with the usual color filter, a display becomes dark. So, with each operation gestalt, as shown in drawing 5 , it light-color-izes and forms so that the minimum permeability 501 in the visible region of each coloring layer of R, G, and B of a color filter may become 30 - 50%. Light color-ization of a coloring layer is made by making thickness of a coloring layer thin or making low concentration of the pigment mixed in a coloring layer, or a color. By this, when performing a reflective mold display, it can constitute so that brightness of a display may not be reduced.

[0043] (The 3rd operation gestalt) Three examples of the electronic equipment of this invention according to claim 6 are shown. Since the liquid crystal equipment of this invention is a reflective mold, it is used under various environments and fits the pocket device for which a low power is moreover needed. For example, drawing 6 (a) is a cellular phone, (b) is a watch and (c) is a portable information device. It is the optimal when the liquid crystal equipment of this invention does not have a blot (dotage) of the display by the scattered plate etc., and you need a high definition display, since display quality is high. In recent years, many electronic equipment with the high frequency of a cellular phone is manufactured and sold by increase of amount of information, and maintenance of the information infrastructure. The liquid crystal equipment of this invention is the the best for the display of such electronic equipment, and the display with coloring sufficient occasionally very especially whose color display is the need is enabled.

[0044]

[Effect of the Invention] As explained above, according to this invention, in a scattered plate and high-reflective-liquid-crystal equipment with a specular reflection layer, the clear display which stopped a blot (dotage), color mixture, etc. of a display with a diffusion plate can be performed.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] Liquid crystal equipment characterized by coming to set the distance L between said scattered plates and said reflecting layers as 300 micrometer<=L <=1000micrometer in the liquid crystal equipment with which a liquid crystal layer is pinched between the 1st substrate and the 2nd substrate, a scattered plate and a polarizing plate are arranged at a different side from said liquid crystal layer of said 1st substrate, and it comes to form a reflecting layer in the field by the side of said liquid crystal layer of said 2nd substrate.
[Claim 2] In the liquid crystal equipment with which a liquid crystal layer is pinched between the 1st substrate and the 2nd substrate, a scattered plate and a polarizing plate are arranged at a different side from said liquid crystal layer of said 1st substrate, and it comes to form a reflecting layer in the field by the side of said liquid crystal layer of said 2nd substrate Liquid crystal equipment with which the distance L between said scattered plates and said reflecting layers and relation with the pixel pitch P are characterized by coming to be set as 1 <=L/P<=10.
[Claim 3] Liquid crystal equipment according to claim 1 or 2 characterized by coming to form said liquid crystal layer with the liquid crystal which has a negative dielectric anisotropy.
[Claim 4] Liquid crystal equipment given in claim 1 characterized by said reflecting layer serving as a pixel electrode thru/or any 1 term of 3.
[Claim 5] Liquid crystal equipment given in claim 1 characterized by coming to arrange at least one phase contrast plate between said 1st substrate and said polarizing plates thru/or any 1 term of 4.
[Claim 6] Liquid crystal equipment given in claim 1 characterized by said reflecting layer and said thing [coming to form the 1st set of a color filter in a wooden floor] thru/or any 1 term of 5.
[Claim 7] Claims 1-6 are electronic equipment carrying the liquid crystal equipment of a publication either.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is outline drawing of longitudinal section showing the outline structure of the 1st operation gestalt of the liquid crystal equipment concerning this invention.
[Drawing 2] It is outline drawing of longitudinal section showing the outline structure of the 2nd operation gestalt of the liquid crystal equipment concerning this invention.
[Drawing 3] It is a 1-pixel schematic diagram.
[Drawing 4] It is outline drawing of longitudinal section of the high reflective liquid crystal using a scattered plate.
[Drawing 5] It is drawing showing the light transmittance for every coloring layer of a color filter.
[Drawing 6] It is the schematic diagram of the electronic equipment carrying the liquid crystal equipment concerning this invention.
[Description of Notations]
101, 102, 201, 202, 404, 412 Glass substrate
103 203 Reflector
104 204 Sealant
105, 205, 409 Liquid crystal layer
106, 206, 401 Polarizing plate
107, 108, 207, 402 Phase contrast plate
109, 208, 403 Scattered plate
110, 209, 405 Color filter
111, 210, 406 Protective coat
112, 211, 407 Transparent electrode
301 1 Pixel
408 410 Orientation film
411 Reflecting Layer
501 The Minimum Permeability

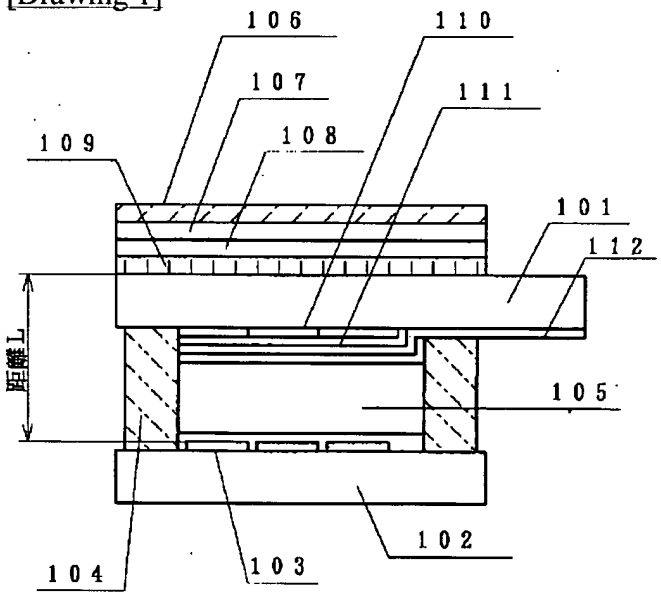
[Translation done.]

* NOTICES *

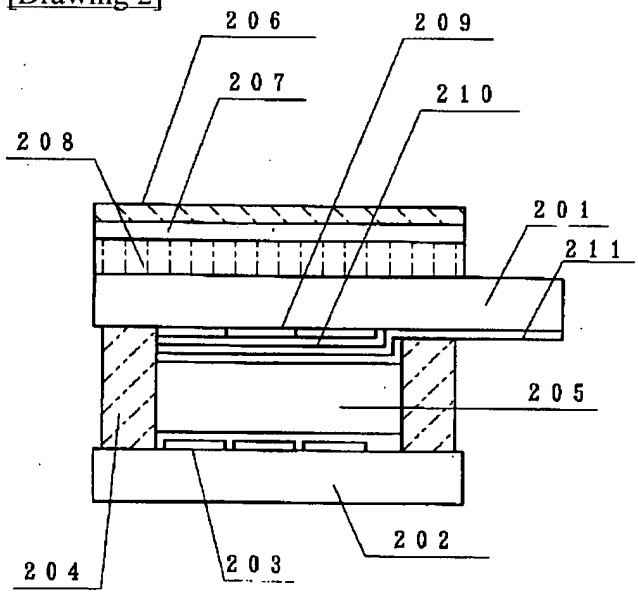
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

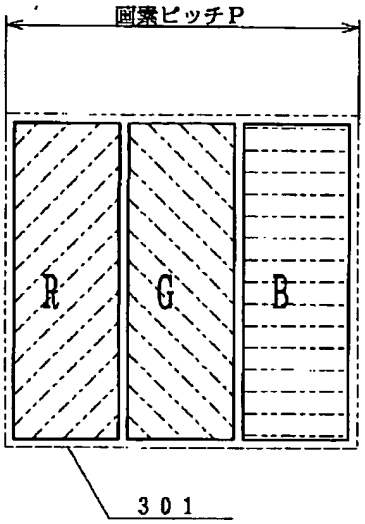
[Drawing 1]



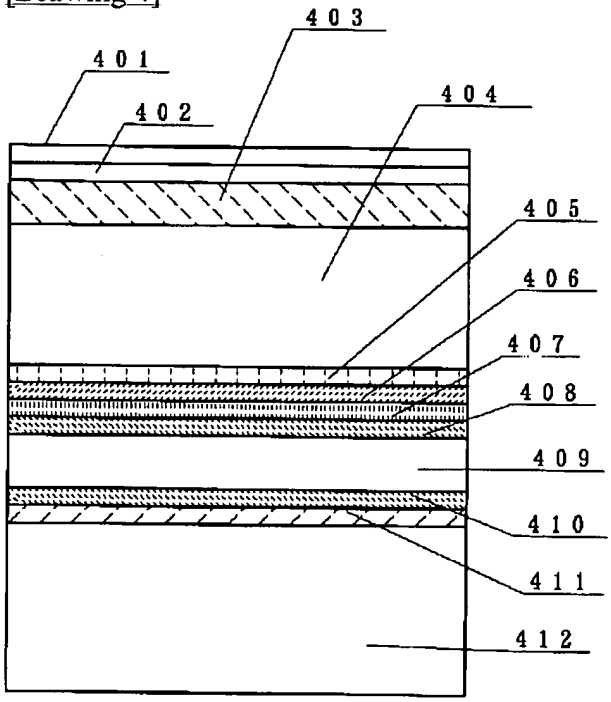
[Drawing 2]



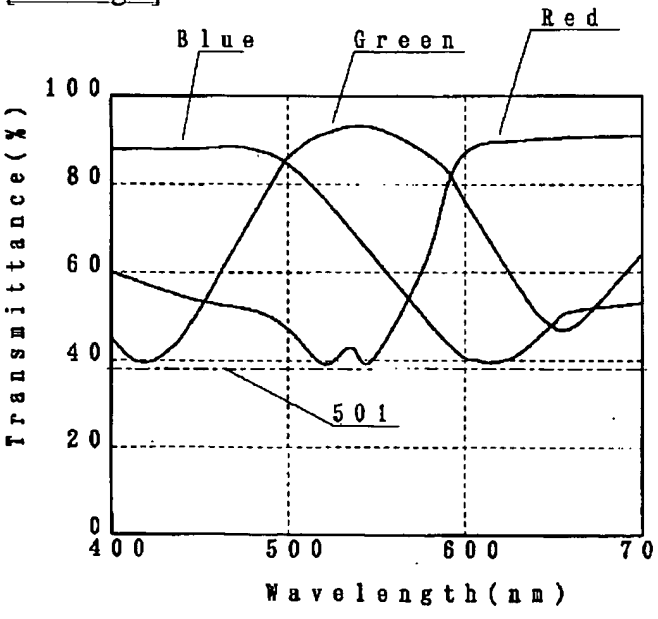
[Drawing 3]



[Drawing 4]

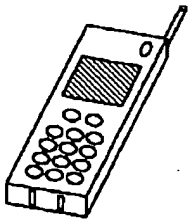


[Drawing 5]

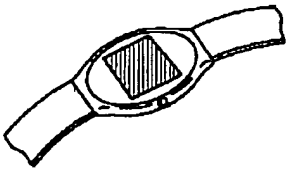


[Drawing 6]

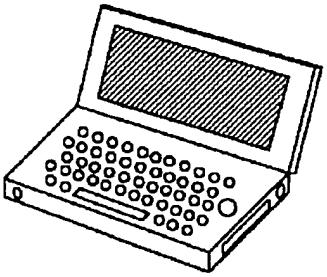
(a)



(b)



(c)



[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
[Section partition] The 2nd partition of the 6th section
[Publication date] September 26, Heisei 13 (2001. 9.26)

[Publication No.] JP,11-237623,A
[Date of Publication] August 31, Heisei 11 (1999. 8.31)
[Annual volume number] Open patent official report 11-2377
[Application number] Japanese Patent Application No. 10-39357
[The 7th edition of International Patent Classification]

G02F 1/1335 520

[FI]

G02F 1/1335 520

[Procedure revision]
[Filing Date] December 7, Heisei 12 (2000. 12.7)
[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] Claim
[Method of Amendment] Modification
[Proposed Amendment]
[Claim(s)]
[Claim 1] In the liquid crystal equipment with which a liquid crystal layer is pinched between the 1st substrate and the 2nd substrate, a scattered plate and a polarizing plate are arranged at a different side from said liquid crystal layer of said 1st substrate, and it comes to form a reflecting layer in said liquid crystal layer side of said 2nd substrate,
Liquid crystal equipment characterized by coming to set the distance L between said scattered plates and said reflecting layers as 300 micrometer<=L <=1000micrometer.
[Claim 2] In the liquid crystal equipment with which it comes to pinch a liquid crystal layer between the 1st substrate and the 2nd substrate,
A scattered plate is arranged at said 1st substrate side,
It has a reflecting layer in said 2nd substrate side,
Liquid crystal equipment characterized by realizing 300 micrometer<=L <=1000micrometer relation when distance between said scattered plates and said reflecting layers is set to L.
[Claim 3] In the liquid crystal equipment with which a liquid crystal layer is pinched between the 1st substrate and the 2nd substrate, a scattered plate and a polarizing plate are arranged at a different side from said liquid crystal layer of said 1st substrate, and it comes to form a reflecting layer in said liquid crystal layer side of said 2nd substrate,
Liquid crystal equipment with which the distance L between said scattered plates and said reflecting layers and relation with the pixel pitch P are characterized by coming to be set as 1 <=L/P<=10.
[Claim 4] In the liquid crystal equipment with which it comes to pinch a liquid crystal layer between the 1st substrate and the 2nd substrate,
A scattered plate is arranged at said 1st substrate side,
It has a reflecting layer in said 2nd substrate side,

Liquid crystal equipment characterized by realizing the relation of 1 <=L/P<=10 when distance between said scattered plates and said reflecting layers is set to L and the pixel pitch of said liquid crystal equipment is set to P.
[Claim 5] Liquid crystal equipment according to claim 1 to 4 characterized by coming to form said liquid crystal layer with the liquid crystal which has a negative dielectric anisotropy.
[Claim 6] Liquid crystal equipment according to claim 1 to 5 characterized by said reflecting layer serving as a pixel electrode.
[Claim 7] Liquid crystal equipment according to claim 1 to 6 characterized by said reflecting layer and said thing [coming to form the 1st set of a color filter in a wooden floor].
[Claim 8] In the liquid crystal equipment with which it comes to pinch a liquid crystal layer between the 1st substrate and the 2nd substrate,
A polarizing plate is arranged at said 1st substrate side,
It has a reflecting layer in said 2nd substrate side,
It has a scattered plate between said 1st substrate and said polarizing plate,
Liquid crystal equipment characterized by providing the phase contrast plate which mainly has a forward-scattering property between said polarizing plates and said scattered plates.
[Claim 9] In the liquid crystal equipment with which it comes to pinch a liquid crystal layer between the 1st substrate and the 2nd substrate,
A polarizing plate is arranged at a different side from said liquid crystal layer of said 1st substrate,
It has a reflecting layer in said liquid crystal layer side of said 2nd substrate,
Liquid crystal equipment characterized by providing the scattered plate which mainly has a forward-scattering property between said polarizing plate and said 1st substrate.
[Claim 10] Claims 1-9 are electronic equipment carrying the liquid crystal equipment of a publication either.
[Procedure amendment 2]
[Document to be Amended] Specification
[Item(s) to be Amended] 0010
[Method of Amendment] Modification
[Proposed Amendment]
[0010] A liquid crystal layer is pinched between the 1st substrate and the 2nd substrate, a scattered plate and a polarizing plate are arranged at a different side from said liquid crystal layer of said 1st substrate, and the liquid crystal equipment of this invention is characterized by coming to set the distance L between said scattered plates and said reflecting layers as 300 micrometer<=L <=1000micrometer in the liquid crystal equipment with which it comes to form a reflecting layer in said liquid crystal layer side of said 2nd substrate. Or in the liquid crystal equipment with which it comes to pinch a liquid crystal layer between the 1st substrate and the 2nd substrate, when a scattered plate is arranged at said 1st substrate side, it has a reflecting layer in said 2nd substrate side and distance between said scattered plates and said reflecting layers is set to L, it is characterized by realizing 300 micrometer<=L <=1000micrometer relation.
[Procedure amendment 3]
[Document to be Amended] Specification
[Item(s) to be Amended] 0015
[Method of Amendment] Modification
[Proposed Amendment]
[0015] Moreover, sequential arrangement is carried out and a scattered plate and a polarizing plate are characterized by the distance L of said scattered plate and said reflecting layer and the relation of the pixel pitch P being 1 <=L/P<=10 at the side in which a liquid crystal layer is pinched between the 1st substrate and the 2nd substrate, and the liquid crystal equipment of this invention differs from said liquid crystal layer of said 1st substrate in the liquid crystal equipment with which it comes to form a reflecting layer at said liquid crystal layer side of said 2nd substrate. Or in the liquid crystal equipment with which it comes to pinch a liquid crystal layer between the 1st substrate and the 2nd substrate, when the scattered plate has been arranged at said 1st substrate side, it has a reflecting layer in said 2nd substrate side, distance between said scattered plates and said reflecting layers is set to L and the pixel pitch of said liquid crystal equipment is set to P, it is characterized by realizing the relation of 1 <=L/P<=10.
[Procedure amendment 4]
[Document to be Amended] Specification
[Item(s) to be Amended] 0018
[Method of Amendment] Modification
[Proposed Amendment]

[0018] Moreover, said liquid crystal layer is characterized by coming to be formed with the liquid crystal which has a negative dielectric anisotropy. When a dielectric constant anisotropy uses negative liquid crystal, liquid crystal is perpendicularly arranged to a substrate. Liquid crystal (liquid crystal molecule) can control the transparency condition of inclination light by control of electric field. It has the effectiveness that a viewing-angle property spreads sharply, by having used such liquid crystal.
[Procedure amendment 5]
[Document to be Amended] Specification
[Item(s) to be Amended] 0019
[Method of Amendment] Modification
[Proposed Amendment]
[0019] Moreover, it is characterized by said reflecting layer serving as a pixel electrode.
[Procedure amendment 6]
[Document to be Amended] Specification
[Item(s) to be Amended] 0021
[Method of Amendment] Modification
[Proposed Amendment]
[0021] Moreover, it is characterized by arranging at least one phase contrast plate between said 1st substrate and said polarizing plates.
[Procedure amendment 7]
[Document to be Amended] Specification
[Item(s) to be Amended] 0023
[Method of Amendment] Modification
[Proposed Amendment]
[0023] Moreover, it is characterized by said reflecting layer and said thing [having formed the 1st set of a color filter in the wooden floor].
[Procedure amendment 8]
[Document to be Amended] Specification
[Item(s) to be Amended] 0025
[Method of Amendment] Modification
[Proposed Amendment]
[0025] Moreover, in the liquid crystal equipment with which it comes to pinch a liquid crystal layer between the (1) 1st substrate, and the 2nd substrate, a polarizing plate is arranged at said 1st substrate side, it has a reflecting layer in said 2nd substrate side, and the liquid crystal equipment of this invention is said 1st substrate. It has a scattered plate between said polarizing plates, and is a phase contrast plate between said polarizing plates and said scattered plates. it is characterized by what it has for the scattered plate which comes out, a polarizing plate is arranged at a different side equipped with the above from said liquid crystal layer of said 1st substrate, has [exists,] a reflecting layer in said liquid crystal layer side of said 2nd substrate, and mainly has a forward-scattering property between said polarizing plate and said 1st substrate.
[Procedure amendment 9]
[Document to be Amended] Specification
[Item(s) to be Amended] 0026
[Method of Amendment] Modification
[Proposed Amendment]
[0026] moreover, the electronic equipment of this invention -- the inside of the above -- either -- it is characterized by carrying the liquid crystal equipment of a publication. According to this means, the electronic equipment using the liquid crystal equipment which can perform the reflective mold display without a blot (dotage) of the display by the scattered plate etc. is realizable.
[Procedure amendment 10]
[Document to be Amended] Specification
[Item(s) to be Amended] 0043
[Method of Amendment] Modification
[Proposed Amendment]
[0043] (The 3rd operation gestalt)
Three examples of the electronic equipment of this invention are shown. Since the liquid crystal equipment of this invention is a reflective mold, it is used under various environments and fits the pocket device for which a low power

is moreover needed. For example, drawing 6 (a) is a cellular phone, (b) is a watch and (c) is a portable information device. It is the optimal when the liquid crystal equipment of this invention does not have a blot (dotage) of the display by the scattered plate etc., and you need a high definition display, since display quality is high. In recent years, many electronic equipment with the high frequency of a cellular phone is manufactured and sold by increase of amount of information, and maintenance of the information infrastructure. The liquid crystal equipment of this invention is the the best for the display of such electronic equipment, and the display with coloring sufficient occasionally very especially whose color display is the need is enabled.

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平11－237623

(43)公開日　平成11年(1999)８月31日

(51)Int.Cl.[6]	識別記号	ＦＩ
Ｇ０２Ｆ　1/1335	５２０	Ｇ０２Ｆ　1/1335　５２０

審査請求　未請求　請求項の数７　ＯＬ　（全７頁）

(21)出願番号　特願平10－39357

(22)出願日　平成10年(1998)２月20日

(71)出願人　000002369
セイコーエプソン株式会社
東京都新宿区西新宿２丁目４番１号

(72)発明者　前田　強
長野県諏訪市大和３丁目３番５号　セイコーエプソン株式会社内

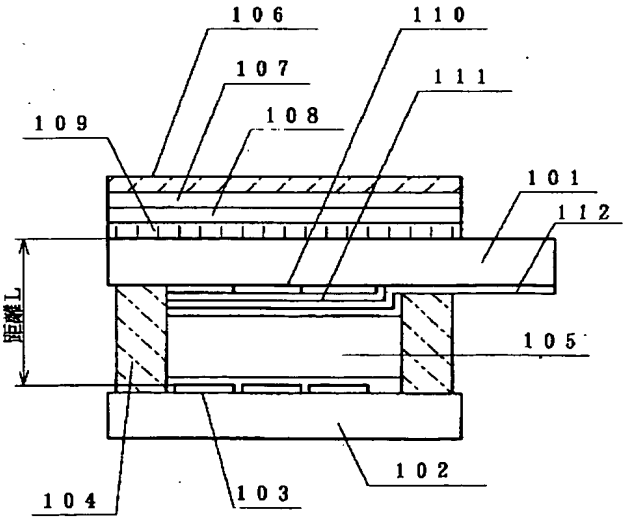
(74)代理人　弁理士　鈴木　喜三郎　（外２名）

(54)【発明の名称】　液晶装置及び電子機器

(57)【要約】

【課題】　散乱板と鏡面反射層を持つ反射型液晶装置において、散乱板による表示のにじみ（ボケ）や混色などを抑えた液晶装置を提供することにある。

【解決手段】　第１基板と第２基板との間に液晶層が挟持され、前記第１基板の前記液晶層と異なる側に散乱板と偏光板が順次配置され、前記第２基板の前記液晶層側の面に反射層が形成されてなる液晶装置において、前記散乱板と前記反射層の距離Ｌを３００μｍ≦Ｌ≦１０００μｍとする。また、画素ピッチＰと前記距離Ｌとの関係を１≦Ｌ／Ｐ≦1.0とする。



1

【特許請求の範囲】

【請求項１】　第１基板と第２基板との間に液晶層が挟持され、前記第１基板の前記液晶層と異なる側に散乱板と偏光板が配置され、前記第２基板の前記液晶層側の面に反射層が形成されてなる液晶装置において、前記散乱板と前記反射層との間の距離Ｌが、３００μｍ≦Ｌ≦１０００μｍに設定されてなることを特徴とする液晶装置。

【請求項２】　第１基板と第２基板との間に液晶層が挟持され、前記第１基板の前記液晶層と異なる側に散乱板と偏光板が配置され、前記第２基板の前記液晶層側の面に反射層が形成されてなる液晶装置において、前記散乱板と前記反射層との間の距離Ｌと画素ピッチＰとの関係が、１≦Ｌ／Ｐ≦１０に設定されてなることを特徴とする液晶装置。

【請求項３】前記液晶層が負の誘電異方性を有する液晶により形成されてなることを特徴とする請求項１または２に記載の液晶装置。

【請求項４】　前記反射層が画素電極を兼ねていることを特徴とする請求項１乃至３のいずれか１項に記載の液晶装置。

【請求項５】　前記第１基板と前記偏光板の間に少なくとも１枚の位相差板が配置されてなることを特徴とする請求項１乃至４のいずれか１項に記載の液晶装置。

【請求項６】　前記反射層と前記第１基板の間にカラーフィルタが形成されてなることを特徴とする請求項１乃至５のいずれか１項に記載の液晶装置。

【請求項７】　請求項１から６のいずれか記載の液晶装置を搭載した電子機器。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は液晶装置及びこの液晶装置を用いた電子機器に関する。

【０００２】

【従来の技術】従来、反射型の液晶装置としては、２枚の透明基板の間に液晶層を封止してなる液晶セルの背面側に反射板を配置したものが多く利用されている。このような反射型の液晶装置においては、液晶層の種類や駆動方式などに応じて、液晶セルの前後に偏光板を配置したり、液晶装置の前面側のみに偏光板を配置したり、偏光板を全く必要としなかったりする場合がある。

【０００３】このような形式の反射型液晶装置においては、外光が前面側の透明基板を通して液晶層に入射し、裏面側の透明基板を透過して反射板にて反射された後、再び裏面側の透明基板、液晶層、前面側の透明基板を通過して視認される。この場合に、液晶層と反射板の反射面の間には裏面側の透明基板の厚さ分だけ間隔が生じるため、外光の入射角度によっては入射時において通過する液晶層の画素領域もしくはドット領域と、反射後に通過する液晶層の画素領域もしくはドット領域とが異なる

2

ので、いわゆる視差による表示のにじみやダブルイメージなどが発生するという問題点がある。

【０００４】上記のような問題点を解決する手法としては、特開平９－１１３８９３号公報に記載されているように、外光を反射させる反射板を液晶セルの内面に設けて、視差をなくすというものがある。

【０００５】

【発明が解決しようとする課題】ところが、特開平９－１１３８９３号公報に記載されている反射型の液晶装置においては、異なる屈折率を有する２種類の微小領域から構成される拡散板を液晶セルの前面に配置しているので、拡散板による表示のにじみ（ボケ）が発生するという問題点がある。この拡散板は反射板の鏡面感や金属感をなくし、外光の正反射方向でなくとも明るい表示を得るために用いているわけであるが、この拡散板による散乱のために、異なる各画素での異なる情報が人間の目で認識されるまでに混在してしまう。つまり、隣り合う画素で白表示と黒表示をそれぞれ行っていたとすると、拡散板のために、白表示と黒表示の境界がわかりにくくなり、表示がぼけてしまう。

【０００６】また、近年の携帯機器やＯＡ機器の発展に伴って液晶表示のカラー化が要求されるようになっており、反射型液晶装置を用いるような機器においてもカラー化が必要な場合が多い。ところが、上記公報に記載されている液晶装置とカラーフィルタを組み合わせた方法では、拡散板による散乱のために、表示のにじみ（ボケ）が発生してしまい、十分な発色を得ることができないという問題点がある。

【０００７】その他、特開平７－２８０５５号公報や特開平７－３６０６０号公報に記載されているように、散乱板も液晶セル内面へ形成して、表示のにじみ（ボケ）を抑制する方法が提案されているが、これはコスト高になったり、信頼性が低下したり、所望の散乱特性が得にくいなどの問題があり、実用化には至っていない。

【０００８】そこで本発明は上記問題点を解決するものであり、反射型液晶装置の拡散板による表示のにじみ（ボケ）や混色などを抑えた液晶装置を提供することにある。また、この液晶装置を用いた電子機器を提供することにある。

【０００９】

【課題を解決するための手段】上記課題を解決するために本発明が講じた手段は、以下の通りである。

【００１０】請求項１記載の液晶装置は、第１基板と第２基板との間に液晶層が挟持され、前記第１基板の前記液晶層と異なる側に散乱板と偏光板が順次配置され、前記第２基板の前記液晶層側の面に反射層が形成されてなる液晶装置において、前記散乱板と前記反射層の距離Ｌが、３００μｍ≦Ｌ≦１０００μｍであることを特徴とする。

【００１１】この手段によれば、散乱板と反射層の距離

を実用的でかつできるだけ短くできるので、散乱板による表示のにじみ（ボケ）を抑えることができる。散乱板と反射層はできる限り近接させて配置するのが望ましいが、例えば、図４に示すように散乱板４０３と反射層４１１の間には、配向膜４１０（厚さ：約０．０１μｍ～約０．３μｍ）、液晶層４０９（厚さ：約２μｍ～約１０μｍ）、配向膜４０８（厚さ：約０．０１μｍ～約０．３μｍ）、透明電極４０７（厚さ：約０．１μｍ～約０．３μｍ）、保護膜または絶縁膜４０６（厚さ：約０．５μｍ～約２μｍ）、カラーフィルタ層４０５（厚さ：約０．５μｍ～約３μｍ）、ガラス基板４０４（厚さ：約３００μｍ～約１５００μｍ）などが介在する。散乱板４０３と反射層４１１の距離Ｌに最も寄与が大きいのはガラス基板４０４である。ガラス基板４０４は薄くしすぎると、割れやすいという問題が生じる。このため、極端に薄くすることはできない。しかし、プラスティックフィルムやプラスティック基板を用いると３００μｍ以下も可能になる。

＊【００１２】１３２ｍｍ×２２０ｍｍの解像度チャートの解像度２０００で描かれた印刷物と散乱板の距離をパラメータとして、表示のレベル（ボケ）を調べた。この結果を表１に示す。表中の○は表示のにじみが問題ないレベル、△は表示のにじみが見られるが実用上問題のないレベル、×は表示のにじみが明らかに見られ問題のあるレベルを示している。表１の結果から、印刷物と散乱板の距離が１０００μｍ以下のときに表示のにじみ（ボケ）のない鮮明な表示が得られることがわかる。実用的なガラスの厚さを考慮に入れると、散乱板と反射層の距離Ｌの範囲は３００μｍ以上１０００μｍ以下である。さらに好ましくは、３００μｍ以上７００μｍ以下の範囲の距離Ｌがよい。散乱板と反射層の距離Ｌがこの範囲にあると、非常に軽量で壊れにくく、鮮明な表示が得られる。

【００１３】

【表１】

	ケース1	ケース2	ケース3	ケース4	ケース5	ケース6
解像度チャートからの距離(μm)	100	300	700	1000	1100	1500
表示のレベル	○	○	○	○	△	×

【００１４】次に、本発明に用いる散乱板について述べる。散乱板は積分球式光線透過率測定装置によって測定された全光線透過率と散乱光透過率の比で求められる曇価（ヘイズ）を適当に選択することによって、表示のにじみ（ボケ）を抑制することができる。ヘイズが小さすぎると反射層の鏡面感や金属感が残ってしまい、明るく高画質な表示が得られない。一方、ヘイズが大きすぎると表示のにじみ（ボケ）を抑えるのが困難となり、鮮明でコントラストが高い高画質な表示が得られない。実験によると、好ましいヘイズの範囲は、３０％以上６０％以下であった。また、散乱板は、Ａｓｉａ　Ｄｉｓｐｌａｙ９５，ｐｐ５９９－ｐｐ６０２で東北大学内田教授らが発表しているような、入射光側への散乱（後方散乱）がなく、前方散乱が主であるものがより好ましい。散乱板は、特開平９－１１３８９３号公報に記載されているような指向性を持つ光制御フィルムでも構わない。

【００１５】請求項２記載の液晶装置は、第１基板と第２基板との間に液晶層が挟持され、前記第１基板の前記液晶層と異なる側に散乱板と偏光板が順次配置され、前※記第２基板の前記液晶層側の面に反射層が形成されてなる液晶装置において、前記散乱板と前記反射層の距離Ｌと画素ピッチＰの関係が、１≦Ｌ／Ｐ≦１０であることを特徴とする。

【００１６】この手段によれば、各画素の情報を混在させずに認識することが可能となり、散乱板による表示のにじみ（ボケ）を抑えることができる。画素ピッチＰを２４０μｍ一定として、散乱板と反射層の距離Ｌを変えて表示のにじみ（ボケ）を観察した実験結果を表２に示す。表中の○は表示のにじみが問題ないレベル、△は表示のにじみが見られるが実用上問題のないレベル、×は表示のにじみが明らかに見られ問題のあるレベルを示している。表２の結果から、散乱板と反射層の距離Ｌと画素ピッチＰの関係が、１≦Ｌ／Ｐ≦１０であると、散乱板による表示のにじみ（ボケ）を抑えることができる。特に、工業的で実用的な範囲は、２≦Ｌ／Ｐ≦６である。

【００１７】

【表２】

	ケース1	ケース2	ケース3	ケース4	ケース5	ケース6
画素ピッチP(μm)	240	240	240	240	240	240
距離L(μm)	240	550	700	1500	2400	3000
L／P	1.0	2.3	2.9	6.3	10.0	12.5
表示のレベル	○	○	○	○	△	×

【００１８】請求項３に記載の液晶装置は、前記液晶層が負の誘電異方性を有する液晶により形成されてなることを特徴とする。誘電率異方性が負の液晶を用いることによって液晶は基板に対して垂直に配列する。電界の制御により液晶（液晶分子）は傾き光の透過状態を制御することができる。このような液晶を用いたことによって

視角特性が大幅に広がるという効果を有する。

【００１９】請求項４記載の液晶装置は、前記反射層が画素電極を兼ねていることを特徴とする。

【００２０】この手段によれば、反射層の上に新たに絶縁層や透明電極などを形成する必要がないので、反射層と散乱板との距離を短くすることができる。また、反射面が画素電極を兼ねているので、新たに画素電極を形成する必要がなく、低コストで済む。

【００２１】請求項５記載の液晶装置は、前記第１基板と前記偏光板の間に少なくとも１枚の位相差板を配置することを特徴とする。

【００２２】この手段によれば、反射型表示において良好な表示制御ができるとともに、光の波長分散に起因する色付きなどの色調への影響を低減することができる。位相差板は、散乱板と反射層の距離Ｌを短くするという観点から、偏光板と散乱板の間に配置することが望ましい。

【００２３】請求項６記載の液晶装置は、前記反射層と前記第１基板の間にカラーフィルタを形成したことを特徴とする。

【００２４】この手段によれば、表示のにじみ（ボケ）のない反射型カラー表示を実現することができる。カラーフィルタは、３８０ｎｍ以上７８０ｎｍ以下の波長範囲のすべての光に対して３０％以上の透過率を有しているのが好ましい。このようにすることで、明るい反射型カラー表示を実現することができる。

【００２５】請求項７記載の電子機器は、請求項１から６のいずれか記載の液晶装置を搭載したことを特徴とする。

【００２６】この手段によれば、散乱板による表示のにじみ（ボケ）などのない反射型表示のできる液晶装置を用いた電子機器を実現することができる。

【００２７】

【発明の実施の形態】次に、添付図面を参照して本発明に係る実施形態について説明する。

【００２８】（第１実施形態）図１は本発明に係る液晶装置の第１実施形態の構造を示す概略縦断面図である。この実施形態は基本的に単純マトリクス型の液晶表示装置に関するものであるが、同様の構成によりアクティブマトリクス型の装置や他のセグメント型の装置、その他の液晶装置にも適用することは可能である。

【００２９】この実施形態では、２枚の基板１０１、１０２の間に液晶層１０５が枠状のシール材１０４によって封止された液晶セルが形成されている。液晶層１０５は、所定のツイスト角を持つネマチック液晶で構成されている。前方の透明基板１０１の内面上にはカラーフィルタ１１０が形成され、このカラーフィルタには、Ｒ（赤）、Ｇ（緑）、Ｂ（青）の３色の着色層が所定パターンで配列されている。カラーフィルタの表面上には透明な保護膜１１１が被覆されており、この保護膜の表面

上に複数のストライプ状の透明電極１１２がＩＴＯなどにより形成されている。透明電極１１２の表面上には配向膜が形成され、所定方向にラビング処理が施されている。また、前方の透明基板１０１の外面上に偏光板１０６、位相差板２枚１０７、１０８、散乱板１０９が配置されている。

【００３０】一方、後方基板１０２の内面上には、上記カラーフィルタの着色層毎に形成されたストライプ状の反射電極１０３が上記透明電極１１２と交差するように複数配列されている。ＭＩＭ素子やＴＦＴ素子を備えたアクティブマトリクス型の装置である場合には、各反射電極１０３は矩形状に形成され、アクティブ素子を介して配線に接続される。この反射電極１０３はＣｒやＡｌなどにより形成され、その表面は透明基板１０１の側から入射する光を反射する反射面となっている。反射電極１０３の表面上には上記と同様の配向膜が形成される。

【００３１】まず、反射型の表示について説明する。外光は図１における偏光板１０６、位相差板２枚１０７、１０８、散乱板１０９、カラーフィルタ１１０をそれぞれ透過し、液晶層１０５を通過後、反射電極１０３によって反射され、再び偏光板１０６から液晶セルの外へ出射される。このとき、液晶層１０５への印加電圧によって明状態と暗状態、及びその中間の明るさを制御する。散乱板１０９は、反射電極１０３の鏡面感や金属感を白濁させ、外光の正反射方向以外でも明るい表示を認識することができるようにする効果がある。

【００３２】本実施形態で、散乱板と反射層の間に用いたそれぞれの部材の厚さは、ガラス基板１０１が５５０μｍ、カラーフィルタ層１１０が１μｍ、保護膜（絶縁層）１１１が２μｍ、ＩＴＯ透明電極１１２が０．３μｍ、配向膜が２層で０．２μｍ、液晶層１０５が７．５μｍである。これらを合わせると、散乱板１０９と反射層１０３の距離Ｌは、５６１μｍとなる。この液晶装置は、散乱板による表示のにじみ（ボケ）を可能な限り抑えているので、鮮明でコントラストが高く発色のよい反射型の表示が得られた。

【００３３】上述したような本実施例の構成によれば、散乱板による表示のにじみ（ボケ）などのない反射型カラー液晶装置が実現できた。

【００３４】本実施形態では、反射層が画素電極を兼ねているが、反射層の上に保護膜または絶縁膜を形成してからＩＴＯなどの透明電極を形成して、画素電極としてもよい。

【００３５】（第２実施形態）図２は本発明に係る液晶装置の第２実施形態の構造を示す概略縦断面図である。この実施形態は基本的に単純マトリクス型の液晶表示装置に関するものであるが、同様の構成によりアクティブマトリクス型の装置や他のセグメント型の装置、その他の液晶装置にも適用することは可能である。

【００３６】この実施形態では、２枚の基板２０１、２

０２の間に液晶層２０５が枠状のシール材２０４によって封止された液晶セルが形成されている。液晶層２０５は、負の誘電異方性を持つネマチック液晶で構成されている。前方の透明基板の内面上にはカラーフィルタ２０９が形成され、このカラーフィルタには、Ｒ（赤）、Ｇ（緑）、Ｂ（青）の３色の着色層が所定パターンで配列されている。カラーフィルタの表面上には透明な保護膜２１０が被覆されており、この保護膜２１０の表面上に複数のストライプ状の透明電極２１１がＩＴＯなどにより形成されている。透明電極２１１の表面上には液晶を垂直に配向させる配向膜が形成され、所定方向にラビング処理が施されている。このラビング処理によって、液晶分子はラビング方向に約８５度のプレティルト角を有している。

【００３７】一方、後方の基板２０２の内面上には、上記カラーフィルタの着色層毎に形成されたストライプ状の反射電極２０３が上記透明電極２１１と交差するように複数配列されている。ＭＩＭ素子やＴＦＴ素子を備えたアクティブマトリクス型の装置である場合には、各反射電極２０３は矩形状に形成され、アクティブ素子を介して配線に接続される。この反射電極２０３はＣｒやＡｌなどにより形成され、その表面は透明基板２０１の側から入射する光を反射する反射面となっている。反射電極２０３の表面上には上記と同様の配向膜が形成される。なお、この配向膜にはラビング処理を施さない。

【００３８】反射電極２０３には、１．０重量％のＮｄを添加したＡｌを５００オングストロームの厚みでスパッタした金属膜を用いた。前方の透明基板２０１の外面上に偏光板２０６が配置され、偏光板２０６と透明電極２１１との間に位相差板（１／４波長板）２０７と散乱板２０８が配置されている。

【００３９】外光は図２における偏光板２０６、位相差板２０７、散乱板２０８、カラーフィルタ２０９をそれぞれ透過し、液晶層２０５を通過後、反射電極２０３によって反射され、再び偏光板２０６から液晶セルの外へ出射される。このとき、液晶層２０５への印加電圧によって明状態と暗状態、及びその中間の明るさを制御する。

【００４０】この実施形態では、図３に示すように画素ピッチＰを１８０μｍとし、１画素３０１はＲ（赤）、Ｇ（緑）、Ｂ（青）の３ドットからなる。また、散乱板と反射層の間に用いたそれぞれの部材の厚さは、ガラス基板が７００μｍ、カラーフィルタ層が２μｍ、保護膜（絶縁層）が２μｍ、ＩＴＯ透明電極が０．２μｍ、配向膜が２層で０．１μｍ、液晶層が５μｍである。これらを合わせると、散乱板と反射層の距離Ｌは、７０９．３μｍとなる。このとき、画素ピッチＰと散乱板と反射板の距離Ｌの関係は、Ｌ／Ｐ＝３．９である。この液晶装置は、散乱板による表示のにじみ（ボケ）を可能な限り抑えているので、鮮明でコントラストが高く発色のよい反射型の表示が得られた。

【００４１】上述したような本実施例の構成によれば、散乱板による表示のにじみ（ボケ）などのない反射型カラー液晶装置が実現できた。

【００４２】最後に、上記の各実施形態に用いるカラーフィルタの着色層について述べる。各実施形態においては、反射型表示を行う場合、入射光が一旦カラーフィルタのいずれかの着色層を透過した後、液晶層を通過して反射電極によって反射され、再び着色層を透過してから放出される。したがって、通常の透過型の液晶装置とはことなり、カラーフィルタを二回通過することになるため、通常のカラーフィルタでは表示が暗くなる。そこで、各実施形態では、図５に示すように、カラーフィルタのＲ、Ｇ、Ｂの各着色層の可視領域における最低透過率５０１が３０～５０％になるように淡色化して形成している。着色層の淡色化は、着色層の膜厚を薄くしたり、着色層に混合する顔料若しくは染料の濃度を低くしたりすることによってなされる。このことによって、反射型表示を行う場合に表示の明るさを低下させないように構成することができる。

【００４３】（第３実施形態）本発明の請求項６記載の電子機器の例を３つ示す。本発明の液晶装置は、反射型なので、様々な環境下で用いられ、しかも低消費電力が必要とされる携帯機器に適している。例えば、図６（ａ）は携帯電話であり、（ｂ）はウォッチであり、（ｃ）は携帯情報機器である。本発明の液晶装置は散乱板による表示のにじみ（ボケ）などがなく表示品質が高いので、高精細な表示を必要とする場合には最適である。近年、情報量の増大と情報インフラの整備によって、携帯の頻度が高い電子機器が数多く製造・販売されている。このような電子機器の表示部には本発明の液晶装置は最適であり、特にカラー表示が必要な時には非常に発色のよい表示を可能にする。

【００４４】

【発明の効果】以上説明したように本発明によれば、散乱板と鏡面反射層を持つ反射型液晶装置において、拡散板による表示のにじみ（ボケ）や混色などを抑えた鮮明な表示を行うことができる。

【図面の簡単な説明】

【図１】本発明に係る液晶装置の第１実施形態の概略構造を示す概略縦断面図である。

【図２】本発明に係る液晶装置の第２実施形態の概略構造を示す概略縦断面図である

【図３】１画素の概略図である。

【図４】散乱板を用いた反射型液晶の概略縦断面図である。

【図５】カラーフィルタの着色層毎の光透過率を示す図である。

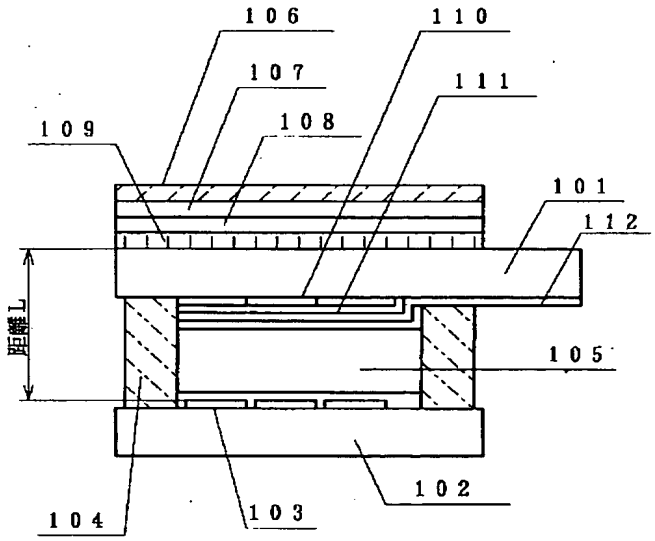
【図６】本発明に係る液晶装置を搭載した電子機器の概略図である。

【符号の説明】

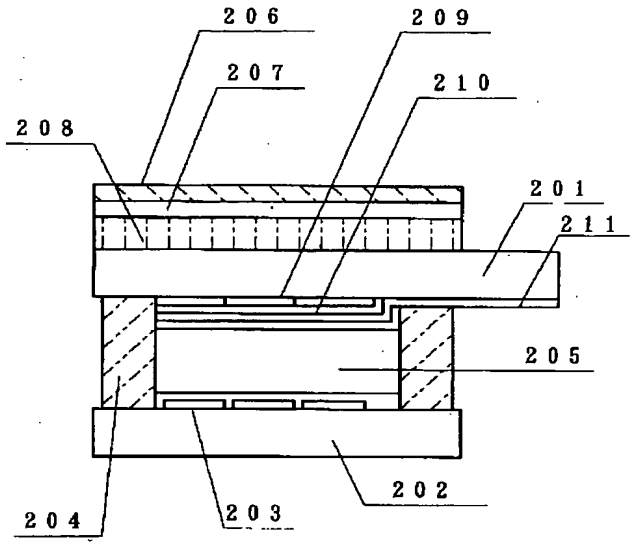
１０１、１０２、２０１、２０２、４０４、４１２　ガラス基板
１０３、２０３　反射電極
１０４、２０４　シール材
１０５、２０５、４０９　液晶層
１０６、２０６、４０１　偏光板
１０７、１０８、２０７、４０２　位相差板

１０９、２０８、４０３　散乱板
１１０、２０９、４０５　カラーフィルタ
１１１、２１０、４０６　保護膜
１１２、２１１、４０７　透明電極
３０１　１画素
４０８、４１０　配向膜
４１１　反射層
５０１　最低透過率

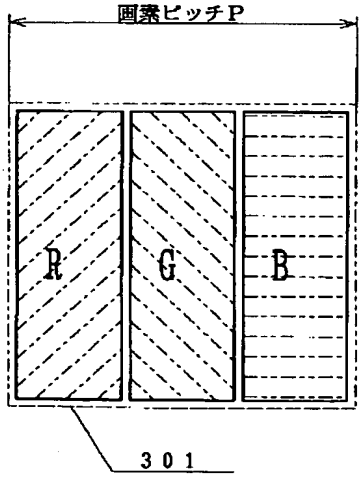
【図１】



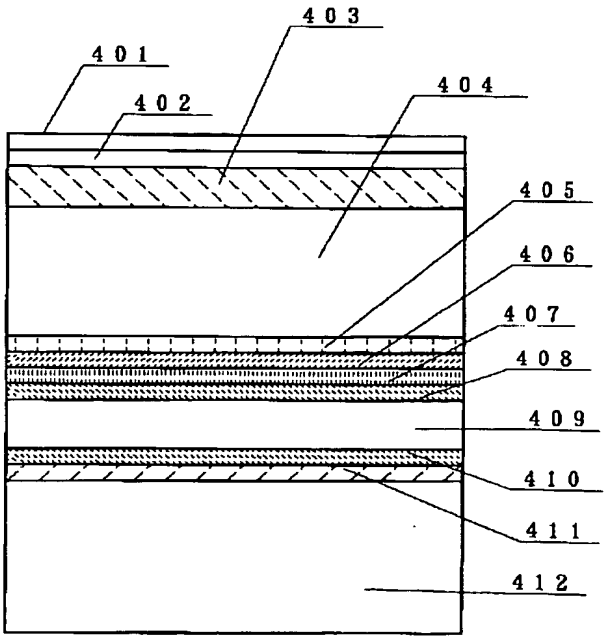
【図２】



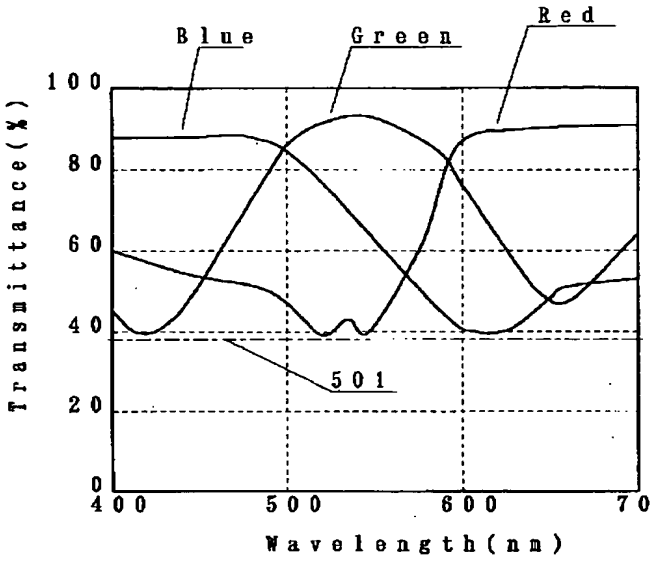
【図３】



【図４】

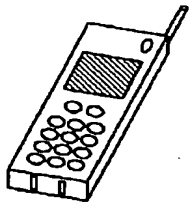


【図５】

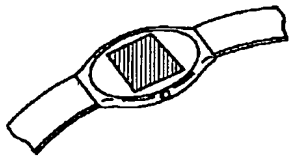

Blue
Green
Red
100
80
60
40
20
0
Transmittance(%)
400
500
600
70
Wavelength(nm)
501

【図６】

(a)



(b)



(c)